

“Unwanted Object Removal In A Video By Using Video Inpainting Technique”

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Abstract— The process of removing the specific areas or repairing the damaged area in a video is known as video inpainting. It is also a unique tool for filling the missing part in a video sequence. In this work the inpainting algorithm is proposed that can deal with removing the unwanted object in a video. Firstly the video converted into number of frames and then inpainting algorithm is applied to each frame by maintaining its spatial consistency and temporal continuity. The second scenario includes inpainting of unwanted moving objects from the video which requires proper tracking of dynamic objects, for tracking RGB frames is converted into HSV (hue saturation value) format and then compared it with template matcher. With these two tasks tracking is done, After this applying inpainting algorithm to each frame the resultant video with desired removed unwanted object is obtained. This method automatically select the parameter values and reduce the search region using region of interest (ROI). With this approach, The problem of moving object tracking has been reduced. Experimental results and statistics shows the effectiveness and efficiency of this proposed method with good inpainting results, and time required to inpaint the frame is in milliseconds. As an add on we provided the mechanism to select the unwanted object as per the need and requirement across the industries.

Index Terms—Object Removal, Spatial, Temporal, Video Inpainting.

I. INTRODUCTION

The process to remove the specific areas or repairing the damaged area in a video is known as video inpainting. It is also a unique tool for filling the missing part in a video sequence Formally, inpainting is the way of automatically filling in holes in image or video using information from surrounding area in such a way that it is difficult for the observer to find the modified region within the image or video. Therefore, inpainting techniques are also named image/video completion.

Image inpainting, a closely related to video inpainting, but here we have to consider lots of images one by one simultaneously and its commenced very long time ago. In Renaissances, artists updated medieval art work by filling the gaps. This was called inpainting, or retouching. Its purpose was to fill in the missing or damaged parts of the artistic work, and restore its unity. This practice was eventually extended from paintings to digital applications, such as removing

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scratches, dust spot, or even unwanted objects in photography and moving pictures. This time, the scratches in photos and dust spots in films were to be corrected. It was also possible to add or remove objects and elements.

Researchers have been looking for a way to carry out digital image inpainting process automatically. By applying various techniques and after years of effort, they have achieved promising results, even with the images containing complicated objects. However, video inpainting, unlike image inpainting, has just started receiving more attention recently. Videos are an important medium of communication and expression in today's world. Video data are widely used in a variety of areas, such as movie industry, home videos, surveillance and so on. Since most of the video post processing is done manually at the expense of a huge amount of time and money, advanced video post processing techniques, such as automatic old films restoration, automatic unwanted object removal, film postproduction and video editing, began to attract the attention of many researchers.

II. OBJECTIVE

The objective of this work is to develop an approach for video inpainting that can remove the unwanted object in a video sequence & this approach should be able to remove static object in the video sequence and also the periodic moving object with simple background, by maintaining spatial consistency and temporal continuity. For removing the static object, means a non moving object there is no need of tracking algorithm for inpainting, In this case directly inpainting algorithm will work properly and remove the unwanted object from video and Second scenario is if object is moving here there is need of tracking and inpainting both need to be consider and is it is very challenging task to do because without tracking it is not possible to inpaint the moving object. It is also necessary to match the speed of tracking and inpainting for getting the good result.

III. PROPOSED METHOD

Given an input I , as illustrated in figure 3.1, let R represent the region to be filled, and the source region is $S(S=I-R)$, we could chose the candidate exemplars from S .

Our algorithm get the patch priorities use the synthesis task through a best-first filling strategy that depends entirely on the priority values that are assigned to each patch on the fill front.

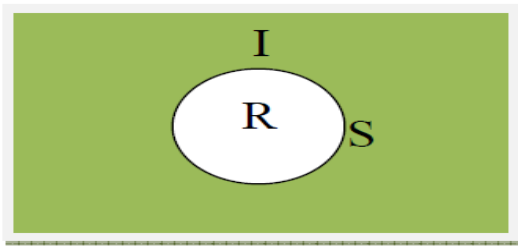


Figure 3.1: The sketch map of image inpainting

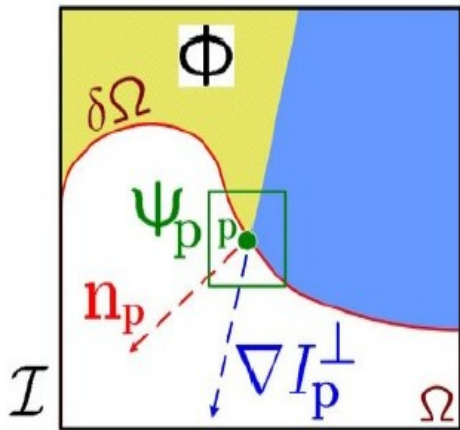


Figure 3.2: Notation diagram

Given the patch ψ_p , n_p is the normal to the contour $\partial\Omega$ of the target region Ω and ΔI_p^\perp is the isophote (direction and intensity) at point p . The entire image is denoted with I . As illustrated in figure 3.2, give a patch ψ_p centre at the point p for $p \in \partial\Omega$, we define its priority $P(p)$ as the product of two terms:

$$P(p) = C(p)D(p)$$

The priority is composed of a confidence term, $C(p)$ and a data term, $D(p)$, both defined over pixels. $C(p)$ The confidence term for pixel p , initialization the function $C(p)$ as follow:

$$C(p) = \begin{cases} 0 & \forall p \in \Omega \\ 1 & \forall p \in 1-\Omega \end{cases}$$

$D(p)$ is the data term for pixel p . It's a function of the strength of isophotes hitting the front $\partial\Omega$ at each iteration, and determines the priority of patch that an isophote "flows" into. We also give the defined of them as follows:

$$C(p) = \frac{\sum_{q \in \psi_p \cap (1-\Omega)} C(q)}{|\psi_p|}$$

$$D(p) = \frac{|\nabla I_p^\perp \cdot n_p|}{a}$$

IV. ALGORITHM

The step of our algorithm for object is summarized below:

- I. Run the code
- II. Select the input video from which object need to remove
- III. Convert video into frames
- IV. Watched video & look towards frame no from where to start inpainting & where to end
- V. Enter start & end frame no and run the inpainting algorithm.
- VI. Select the object which you want to remove
- VII. Select the Region of interest "R" from frame for tracking the moving object
- VIII. Convert frames from RGB to HSV format for tracking
- IX. Track the object in each frame using HSV & template Sum of Difference based Template Matching
- X. Selected Foreground object is Inpainted using proposed Exemplar based method which is discussed above
- XI. Rejoin the frame to get the output video & saved it to hard-disc.

V. RESULT

Database: Images and Video sequence with simple background are used for testing this algorithm, all images are stored in JPEG Format and video sequence in .AVI/ .3GP format

Software used: MATLAB R2013a is used as a platform for coding which is running on Intel i5 processor, with frequency 2.2 GHz along with 2 GB RAM for implementation.

Every Image/Video have background & foreground therefore for simplicity it is broadly divided it into 4 types

- 1) Stationary Background & Stationary Foreground (for image inpainting)
- 2) Stationary Background & Stationary Foreground (for video inpainting)
- 3) Stationary Background & Moving Foreground
- 4) Moving Background & Moving Foreground

1) Result for Stationary Background & Stationary Foreground (for image inpainting):

This is the simplest case of inpainting, it is also named as Image inpainting. Here work is done on single frame as shown in figure 5.1



Figure 5.1 : Show the image inpainting result where frame from wall in the original frame is removed and the background is filled bottom frame represent the inpainted image.

2) Result for Stationary Background & Stationary Foreground (for video inpainting)

This is the case of Video Inpainting here work have to done on so many number of frames simultaneously. In this case video is converted into frames and then the image inpainting algorithm is applied to each frame simultaneously after that all frames are combine and we get the resultant video.

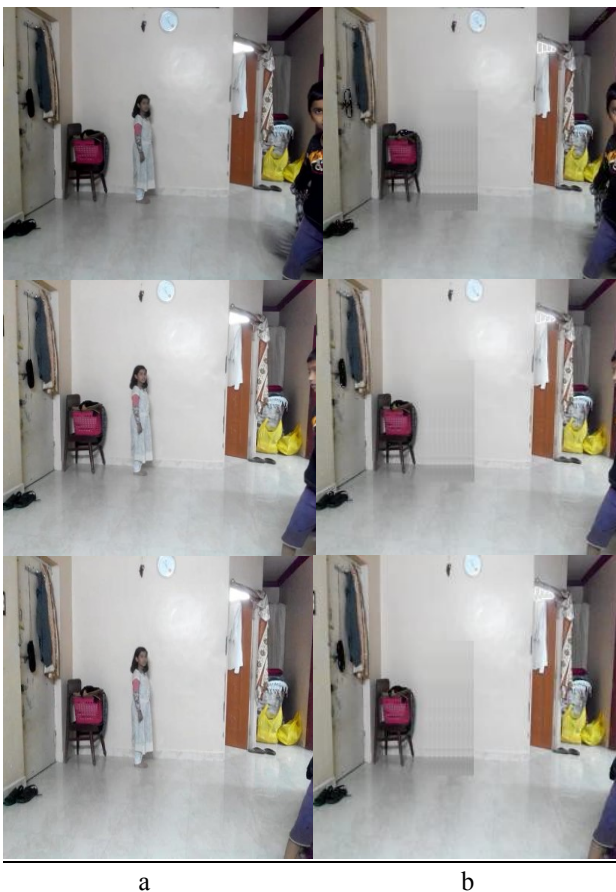


Figure5.2: Video inpainting with stationary background and stationary foreground.

- (a) Three selected frames from the original video sequence.
- (b) The correspondent frames obtained by our algorithm, in which the girl was removed.

This video have total 69 frame out of which only 3 frames are shown in result for understanding, in this work PSNR is calculated for each and every frame and its range for this video is 55 to 58 Db and time required for removing unwanted object in video is 10.1277 seconds for 69 frame that's means for single frame time required is

$$10.1277 / 69 = 0.14 \text{ seconds/frame}$$

which is very less as compare to previous methods.

3) Stationary Background & Moving Foreground:

For working on this type of video tracking is required. For this template matcher is used. A basic method of template matching uses a convolution mask (template), tailored to a specific feature of the search image, which we want to detect. This method can easily applicable on grey images or hsv images. For applying the template matching for tracking, Firstly we need to select the object manually which we want to track in a video sequence. After that template matcher will track the object and inpainting method will remove the unwanted object in a video sequence. In figure 5.3 result of moving object removal is shown.



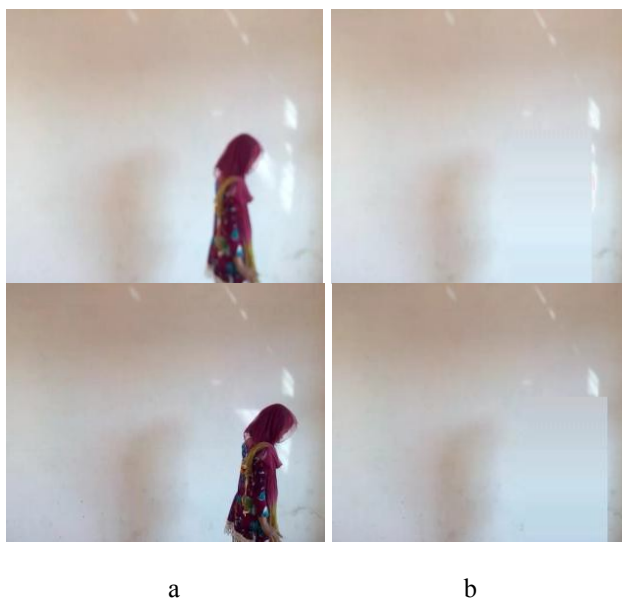


Figure 5.3: Video inpainting with stationary background and moving foreground.

(a) Five selected frames from the original video sequence.

(b) The correspondent frames obtained by our algorithm, in which the moving girl was removed.

This video have total 340 frames out of which only 5 frames are shown in result for understanding, in this work PSNR is calculated for each and every frame and its range for this video is 30.5 to 32.5 dB and time required for removing unwanted object in video is 184.735 seconds for 340 frame that's means for single frame time required is

$$184.735 / 340 = 0.54 \text{ seconds/frame}$$

which is very less as compare to previous methods.

VI. CONCLUSION

From result it can be concluded that proposed algorithm work well for 3 cases out of four which is shown above by effectively maintaining the spatial consistency and temporal continuity after removing static and dynamic area. The experimental results showed a faster processing and high quality result. The proposed method fails when the damaged region is in moving background & moving foreground, also if object is occluded by moving objects or static object and if video recorded with moving camera.

VII. FUTURE SCOPE

Future scope of this paper is to deal with moving background & moving foreground video sequence and also to deal with arbitrary camera motion (including zooms), changes of scale in the moving objects, and dynamic backgrounds. Currently this algorithm does not address complete occlusion of the moving object and work towards adapting the technique to such scenario is going on and also to be addressed are the automated selection of parameters (such as patch size, mosaic size, etc.) and dealing with illumination changes along the sequence. Results towards adapting to illumination changes have recently appeared as an extension.

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